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MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for January, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 162; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 33; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now always reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During the first three days of the month severe storms prevailed over the British Isles and the eastern part of the Atlantic, with reported minimum barometric pressure, 28.86 inches, at Stornoway, Scotland, on the morning of the 2d. During the 12th a storm of marked intensity moved northeastward over New England, with minimum pressure, 28.90 inches, at Eastport, Me. This storm passed over the Gulf of St. Lawrence and Newfoundland during the 13th, and was met by steamers east and northeast of the Grand Banks during the 14th and 15th, after which it apparently dissipated. The third important storm of the month on the North Atlantic passed north of east off the south Atlantic coast of the United States during the 16th, was central north of Bermuda on the morning of the 17th, and passed northeastward over Newfoundland and the Grand Banks during the 18th. On the morning of the 17th advices regarding this storm were telegraphed in the interest of transatlantic shipping to Atlantic coast ports and to London. During the 22d and 23d a storm of marked strength moved northeastward over New England to the Gulf of St. Lawrence and, passing northeastward over Newfoundland during the 24th, apparently united with an extensive area of low barometer which occupied the Atlantic in high latitudes. On the morning of the 25th the lowest barometer reading of the month, 28.70 inches, was reported at Sumburgh, Scotland. During the night of the 27th a storm passed eastward over Newfoundland. This storm appeared to have a slow progressive movement to the eastward, and by the close of the month the North Atlantic Ocean was covered by an area of low barometer of great magnitude, which extended from the Grand Banks to the British Isles and southward over Azores.

The principal cold wave of January, 1902, occurred during the third decade of the month. This cold wave first appeared over the extreme Northwest British Territory on the morning of the 23d, extended over the middle and northern Rocky Mountain districts by the morning of the 24th, and was reinforced during the 25th by intense cold which attended the advance over the middle west and northwest of an extensive area of high barometer; by the morning of the 26th the line of freezing temperature extended into the interior of southern California, to extreme southern New Mexico, and to central Texas. On the morning of the 27th freezing temperature was reported to the Texas coast, the line of zero temperature reached northwestern Texas, and the thermometer readings were twenty to thirty degrees below zero in the States of the middle and upper Missouri, and Red River of the North valleys. The advance of this cold wave to the south Atlantic coast dis-

tricts was interrupted by an area of low barometer which advanced from the west part of the Gulf of Mexico northeastward during the last three days of the month. Ample warnings of the approach of this cold wave were issued in all districts which it visited. Special warnings telegraphed well in advance of the cold wave throughout the Pacific coast and Rocky Mountain districts prompted precautionary measures which resulted in saving large quantities of perishable products. Heavy snow preceded the advance of this cold wave in many of the districts, concerning which ample warnings were given. On the morning of the 29th snow, melting as it fell, was reported at Riverside, Cal.

BOSTON FORECAST DISTRICT.

The storms of the month were not destructive, as the high winds experienced were offshore or westerly winds. Timely warnings were displayed well in advance of the high winds, and the changes in weather and temperature were, as a rule, accurately forecast.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Cold-wave warnings were issued for portions of the district on the 3d, 10th, 20th, 23d, 24th, 26th, and 27th. The warnings were generally timely and no cold waves occurred without warnings. No severe windstorms occurred during the month. The daily forecasts have given general satisfaction, and favorable comments on the work of the Bureau are heard on all sides.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

A severe cold wave covered the entire district during the 26th and 27th. Warnings were issued for all points well in advance of its approach. Winter navigation continued on Lake Michigan during the month. Occasional high winds occurred and messages were sent to all open ports, advising vessel interests of the storm. No casualty occurred during the month, except the grounding on the bar near the mouth of the Ludington Harbor of the car ferry *Pere Marquette* on the night of the 13–14th. Navigation was seriously impeded along the west shore of Lake Michigan by extensive fields of ice during the latter part of the month.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

On the night of the 24th cold-wave warnings were ordered in Utah, western Colorado, and northern New Mexico. On the morning of the 25th cold-wave warnings were given general distribution in Utah and western Colorado, and to points in central and eastern Arizona and southeastern Colorado. A few hours later the following message was given general distribution in Colorado:

Conditions favorable for severe cold and high northerly winds, with heavy snow in mountain districts.

These warnings were issued well in advance of the cold and were fully justified, except in parts of Arizona and New Mexico.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month continued dry, with frost general in California until the 16th, when rain fell from San Francisco northward. The night of the 24th cold-wave warnings were ordered for central and northern California and Nevada. Emergency frost warnings were issued for all points in southern California on the morning of the 25th in ample time to be of service to the orange growers, and emergency frost warnings for southern California were again issued on the morning of the 29th and were verified. Frost warnings were issued on the morning of the 30th. No storms of exceptional severity occurred during the month.—*Alexander G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

On the morning of the 24th a severe cold wave made its appearance in the British Possessions north of Montana. Special reports showed that the cold wave was moving rapidly toward the district and the following cold-wave warning was at once sent to stations east of the Cascade:

Cold wave. Temperature will fall 20° by morning and zero weather will continue several days,

Storm northeast warnings, containing the additional announcement of much colder weather with snow, were sent to all storm warning display stations. The cold-wave warnings were timely and verified in detail, each station being advised about twenty-four hours in advance of the arrival of the cold wave.—*Edward A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	54	114	7, a. m.	47	65	3,450	6.0	575	24.0
II	8, p.m.	41	124	10, a. m.	43	104	1,200	1.5	800	33.3
III	12, a. m.	50	97	15, a. m.	32	65	2,900	3.0	967	40.3
IV	15. a. m.	48	115	16, p.m.	46	78	1,800	1.5	1,200	50.0
V	15, a. m.	43	116	18, p.m.	32	65	3,550	3.5	1,014	42.3
VI	17, a. m.	41	124	21, a. m.	46	60	3,750	4.0	938	39.1
VII	19, p.m.	37	122	23, p.m.	30	82	3,400	4.0	850	35.4
VIII	24, a. m.	54	114	1, p.m.*	46	60	3,775	8.5	444	18.5
Sums							23,825	32.0	6,788	282.9
Mean of 8 paths							2,978		848	35.4
Mean of 32.0 days									746	31.1
I	1, a. m.	51	104	4, a. m.	47	54	2,500	3.0	833	34.7
II	5, p.m.	54	114	7, p.m.	48	86	1,300	2.0	650	27.1
III	7, a. m.	54	114	10, p.m.	48	68	2,600	3.5	743	31.0
IV	10, a. m. / 10, p.m.	37 / 46	87 / 84	13, a. m.	49	64	1,950 / 1,350	3.0 / 2.5	650 / 540	27.1 / 22.5
V	15, p.m.	54	114	20, a. m.	47	54	3,100	4.5	689	28.7
VI	16, a. m.	27	80	17, a. m.	32	65	1,300	1.0	1,300	54.2
VII	16, p.m.	37	114	18, p.m.	32	86	1,700	2.0	850	35.4
VIII	18, a. m.	43	124	23, p.m.	48	63	3,900	5.5	709	29.5
IX	24, a. m.	47	123	26, p.m.	36	87	2,600	2.5	1,040	43.3
X	26, a. m.	47	89	27, a. m.	48	63	900	1.0	900	37.5
Sums							23,200	30.5	8,904	371.0
Mean of 11 paths							2.109		809	33.7
Mean of 30.5 days									761	31.7

*February.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

The stages of the Missouri and upper Mississippi rivers varied but little during the month. The lower Mississippi